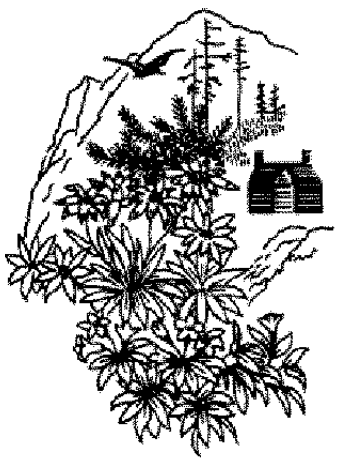

GREEN PAPER

Balancing Environment and Economic Growth

2

by Carrie Meyer

All too often economic growth and environmental degradation have gone hand in hand. The land and its natural resources are exploited without concern for the consequences to the environment and those who must depend upon it for their future. But this seemingly boundless and bountiful earth has limits. Recognition of this has been one of the most difficult but important achievements of the 20th century. Building on this insight is crucial to the 21st century.

Fortunately, a good deal of work has already been done on what is called sustainable development. Simply put, sustainable development means the pursuit of economic growth in ways which benefit or at least are neutral to the natural environment.

In practice this means identifying new approaches to old problems and putting them to work. Some involve developing new technology, others merely a return to older, simpler patterns of behavior. The premise of sustainable development is that economic growth and environmental protection can be mutually supporting. Wise stewardship of natural resources can pay dividends both to those who use them now and those who do so in the future. Adopting sustainable development policies can help developing nations avoid costly environmental problems, freeing up resources for future growth.

SUSTAINABLE WORLD DEVELOPMENT

The 1987 release of a United Nations report — *Our Common Future* — brought sustainable development to policy-makers' attention around the globe. This report by the Commission on Environment and Development (also known as the Brundtland Commission, after the chair of the commission), convincingly demonstrated that environmental degradation can jeopardize prospects for development in developing countries.

The economic value of the environment has often been overlooked. Despite the fact that natural resources such as timber, oil and minerals enter directly into economic production, our principal accounting frameworks have failed to record their depletion as losses of productive assets. Environmental quality is even more difficult to quantify, yet clean air and water are necessary for a healthy and productive labor force. An ecologically sound environment sustains life. Wetlands purify our waters; forests serve as watersheds; the atmosphere regulates the radiation which reaches the earth and our climate.

Increasingly, countries like the United States have begun to assign economic value to environmental assets. Consumers have begun to demand products and services which are in harmony with environmental protection. The employment and income thus generated contribute to the national wealth, rather than detracting from it.

That development and environment are inter-related and that thoughtful policies can enhance the synergy between the two is increasedly

understood throughout the world. The prominence given to sustainable development during the 1992 "Earth Summit" in Rio de Janeiro, Brazil, for example, suggests that such concepts have moved to the forefront of international affairs.

Priorities and possibilities for sustainable development vary enormously among countries and even regions. Developed countries may already have the technology in place to exploit the economic benefits of environmental protection. Research in "green" technologies offers the promise of economic rewards to businesses with the foresight to pursue them. On the other hand, developed countries continue to consume the bulk of the earth's energy and other natural resources and return an enormous burden of waste into global ecological systems.

In developing countries, alleviating poverty is fundamental to achieving sustainable development. Rapid population growth and poverty often pressure people to overuse or abuse the resources which sustain them — especially forests and soils.

Much of the earth's genetic wealth rests in the world's tropical forests, while the political will and economic power to protect them is often absent. International cooperation, which brings together the resources with the means to manage them better, is thus fundamental for sustainable world development.

Achieving this will not be easy. Old patterns of abuse are hard to break and the resources to adopt new strategies are seldom easy to obtain. There are exciting ideas being put to work all around the world, however: ones which do not depend on finances so much as ingenuity and the willingness to look at old habits anew. The rewards from pursuing them promise much, both to the local people and the environment which surrounds them.

PROPERTY RIGHTS

Property rights are a cornerstone for Western economies and the basis upon which most economic activity takes place. Without them, goods could not be sold and there would be no investment in economic activity.

The ownership of property, however, also provides incentives for its preservation and protection. When the rights to land are absent or uncertain, there are often incentives to over-exploit the land and little or no incentive to invest in improving it. Thus the environment is needlessly damaged and opportunities for economic growth are lost.

In those countries with rapidly growing populations, great pressure is often put on marginal lands, which can be quickly depleted by over-cultivation, grazing and the search for firewood. Frontier areas — typically forests and other ecologically fragile zones — are often unsuitable for commercial agriculture, or indeed, cultivation of any kind.

These lands are often owned by the state and poorly monitored (as in many parts of Asia) or owned by large landowners and underutilized (as in Latin America). Despite their poor prospects for agriculture, they may be seen as "free" for the taking by those desperate enough to risk cultivating land that they do not own. Under such circumstances, the long-term benefits to preserving the land are considered secondary.

Typically, under state ownership everyone owns the land but in effect no one does; the forests are left vulnerable to over-exploitation. Governments in need of export earnings often sell timber rights to logging companies who open the land for migrants.

LAND OWNERSHIP BY INDIGENOUS TRIBES IN PAPUA NEW GUINEA

Papua New Guinea provides an important exception to Asia's common practice of publicly owning forests through its forest management policies based on customary communal management. Ownership of 90 to 97 percent of the nation's land mass has remained with communities, rather than individuals. Thus almost all the country's forests remain in the hands of the people who have a real interest in preserving them.

As a result, the forest is managed more sustainably and forest dwellers benefit. Recent rates of deforestation are only about .1 percent per year. Other countries in Asia experience deforestation rates from 10 to over 20 times higher — more than enough to account for greater population densities. For a country with most of the population still employed in agriculture, per capita income is relatively high.

Companies seeking logging rights in Papua New Guinea must deal with those communities who have secure tenure and depend on the land for farming and for a multitude of forest products. Communal ownership also prevents an individual from selling out for immediate gain.

To encourage community-based tenure rights in other countries, the U.S. Agency for International Development (USAID) has funded research through the Center for International Development and Environment at the World Resources Institute. Countries under analysis include Sri Lanka, Indonesia, the Philippines, Thailand and Nepal.

FOREST REGENERATION THROUGH COMMUNITY FORESTRY IN INDIA

India's forests have had a very different experience from those of Papua New Guinea. Forests in India were treated as "open access" resources (for everyone's use) until the mid-19th century. Under British rule the forests were rapidly exploited — both by the government and by the people. The resultant loss of forests eventually stimulated government control. In the face of rapid population growth and the pressure of poverty, however, in pre- and post-independence India, the state could do little to protect the forests from the ever-increasing needs of the people and the demands of those who exploited them for commercial timber.

It finally became clear to foresters, that "protecting" the forest from the people who need it was futile. At the same time, local people began to realize that they had to act if they were going to save the forests at all. The result has been much more than a slowing of degradation. Forests have actually been regenerated in areas of West Bengal, despite constant pressure from a growing population.

But not only have the forests been expanding, so, too, has the local economy which depends upon them. The best-known forest regeneration project began as a research project in 1972 at Arabari Research Station in West Bengal. Rapid deforestation in the region prompted the district forest officer to elicit the cooperation of the local inhabitants. Interviews with 1,300 people in 11 villages revealed the extent to which villagers supported themselves in the off-season from the illegal cutting and selling of firewood. They also revealed that they understood the devastating effects of the deforestation.

A Forest Protection Committee was established incorporating the 11 villages with a population of 618 households. The villagers include farmers, artisans, pastoralists and landless laborers. Off-season work was provided by the government in exchange for the promise of forest protection. In addition, the villagers received 25 percent of the selling price of the mature trees through a revenue-sharing agreement with the Forest Department, as well as the rights to all non-wood forest products.

With this transfer of rights, the villagers not only refrained from cutting wood for themselves, but also protected the forest from others who might encroach upon it. Within 15 years, the forest had regenerated and the villagers were much better off as measured by household wealth.

During the mid-1980s many more Forest Protection Committees were established throughout the region, and by the end of the decade there were 1,300 such committees active in an area encompassing almost 40 percent of the state forest land in West Bengal. The result has been a regeneration of the forests and a four-fold increase of household income.

The experience in West Bengal is spreading throughout India, initiated either by foresters or by the village communities themselves. In West Bengal, Gujarat, Haryana and Himachal Pradesh, foresters began discussions with communities, but in other states such as Orissa, Bihar and Madhya Pradesh, the local people have taken the initiative — working either with the forest department or with non-governmental organizations.

Policymakers in India have also been convinced. The governments of Orissa and West Bengal issued orders in 1988 and 1989 to involve people in the management of the forests. National policies also now encourage cooperation between forest departments and the local communities. Only by extending rights and responsibilities to those local communities who depend on the forests can they be managed sustainably.

The customary rights of indigenous peoples are often brushed aside. Common or public areas that once sufficed for grazing and firewood needs are now over-exploited and degraded. The inability to supervise remote forests even under the best management schemes has also led to the destruction of forests in many areas, especially throughout Asia.

"GREEN" ACCOUNTING

Preservation of the environment and economic growth may appear to be at odds because national accounting systems do not properly account for natural assets. Including environmental information in our accounting systems, however, reveals the productive and economic value of natural assets and provides the basis for more judicious policy decisions. This is what is sometimes known as "green" accounting.

When man-made assets wear out, the loss is subtracted from national income, but no similar deduction is made for the depletion of oil, timber and minerals which are also productive assets. Thus as forests are felled and oil pumped from the ground, gross domestic product (GDP) increases rapidly — indicating to policymakers that economic growth is occurring. In reality, the depletion and degradation of environmental assets and services threaten future production and consumption. A true picture of net income can only be obtained by recognizing the costs of resource depletion as depreciation.

The recognition of natural resource depletion is a glaring omission in national income accounts. Other environmental costs should also be considered. Costs imposed on businesses and consumers by a polluted environment also typically go

RESOURCE DEPLETION AND DEGRADATION: THREE EXAMPLES

Efforts — by public and private institutions and individuals — are already under way to incorporate natural resource and environmental accounting into "greener" systems of national accounts. Thus, the World Resources Institute (WRI) and collaborating institutions have conducted research on resource depletion in Indonesia and Costa Rica. Likewise, the United Nations and the World Bank have developed a system of environmental accounting in Mexico. As in the Indonesian and Costa Rican case studies, the focus is on oil extraction and land use in Mexico.

In the Costa Rican and Indonesian studies, the economically important natural assets of the country were identified — for Indonesia, these were oil, forests (i.e., commercial timber) and soil; for Costa Rica, they were timber, soils and fisheries.

The yearly physical depletion of each of the assets was quantified and, for most of the resources, values based on market prices were then applied to the quantities lost to arrive at the cost of yearly natural resource depreciation in dollar terms.

The results in both cases showed that the loss in natural capital was quite significant — and not to be overlooked when evaluating the sustainable income of the country.

The Costa Rican study showed a rapid loss of natural capital. From 1970 to 1989, the accumulated depreciation in the value of its forests, soils and fisheries amounted to $4.1 thousand-million. Roughly, this reflected an annual loss of over five percent of gross domestic product (GDP). Similarly for Indonesia, while GDP increased at an average annual rate of 7.1 percent from 1971 to 1984, the net domestic product — after adjustment for resource depreciation — increased by only four percent per year. When two percent can mean the difference between recession and healthy economic growth, these figures indicate a major change in the natural assets in the country and in its productive potential.

When the natural resource asset depreciation is compared to total production in the agricultural sector, the figures are quite alarming. In Costa Rica, for example, when the depreciation of the natural resources upon which agricultural production is based was subtracted out, this figure — net agricultural product — was approximately one-half of gross agricultural product in 1989.

In Indonesia, the public, nongovernmental organizations (NGOs) and policymakers were outraged to see the high costs of forest depletion when compared to the low fees which the government had charged timber companies. WALHI, a local umbrella organization for Indonesian environmental NGOs, undertook further research. The government now charges higher forest fees which result in better forest management. The Indonesian Ministry of Population and the Environment has continued environmental accounts with technical and financial support from Statistics Canada and the U.S. Agency for International Development (USAID).

In the U.N.-World Bank case study in Mexico, oil extraction and timber depletion were measured and valued on the basis of market prices. But other environmental impacts of oil extraction and production were also considered. Qualitative effects on the ecosystem were evaluated including air and water pollution, garbage and solid waste, land erosion and groundwater loss. Resource degradation was valued according to the costs of avoiding or repairing the damage.

Much like the Costa Rican case, when national income was adjusted for resource depletion it was 5.7 percent less than the conventionally determined value. When income was adjusted both for resource depletion and degradation, the value was 13 percent less.

Although adjustments to popular aggregates can be startling to the public and policymakers, and incite calls for prompt action for better resource management, analysis by individual economic activities can specify how the depletion and degradation is occurring and what industries are responsible. For example, if agricultural policies have resulted in deforestation and erosion, and in addition, have imposed costs on numerous other sectors, all of these separate impacts need to be traced and evaluated, and weighed against the benefits of the policies.

The results of the Mexican case study convinced local institutions, such as the National Institute of Statistics, Geography and Informatics (INEGI), to carry on this important work.

unrecorded — and result in flawed policy prescriptions.

Developing countries in particular are beginning to consider the costs of resource depletion, since agriculture, forestry, fishing and mining activities often employ the bulk of the population. The economic consequences for developing countries of rapid deforestation and severe erosion and degradation of agricultural land have been serious in recent years, underscoring the need to properly account for these assets in planning for sustainable development.

In Latin America, for example, interest in environmental accounting is growing, encouraged by pioneering research in Costa Rica and Mexico (see box) and spurred by the Earth Summit in Rio de Janeiro in 1992. Building on this interest, a seminar on "Natural

Resource and Environmental Accounts for Development Policy" was sponsored in early 1993 in Washington, D.C., by the Organization of American States (OAS) in cooperation with World Resources Institute. Representatives from public institutions all over Latin America, the United States and Canada came together and took steps to establish an information network in the Americas for countries working on environmental accounting.

Important steps have been taken in individual countries as well: Colombia's most recent constitution calls for some form of environmental accounting. Environmental damage to watersheds has contributed to costly water crises and electricity shortages throughout Central America, Colombia and Ecuador. The public is demanding that an accounting be made of how these resources are being used and how the costs and benefits are allocated.

U.N. Satellite Environmental Accounts

Internationally, major strides have recently been made toward "greener" national accounting systems. In 1993 the United Nations released its *Handbook of Integrated Environmental and Economic Accounting,* which provides guidelines for integrating environmental and economic accounts.

The guidelines recommend that separate environmental accounts — known as "satellite accounts" — be developed to complement the core economic accounts. These satellite accounts, although separate, would be entirely compatible with these core accounts. Instruction is given for the treatment of natural capital depletion (especially minerals and timber) and the costs of degradation of land, water or air. For goods or services that have no market prices, alternative valuation methods are suggested to impute the cost of depletion or degradation.

Although not all countries will choose to maintain satellite environmental accounts, many international organizations, such as the European Community, the International Monetary Fund, the Organization for Economic Cooperation and Development and the World Bank have strongly endorsed the idea. The decision to establish satellite accounts was also endorsed by the governments participating in the 1992 Earth Summit in Rio de Janeiro. In February 1993, the revised system was adopted by the U.N. Statistical Commission and is expected to become the new world standard.

Certainly it is too early to measure the environmental benefits of institutionalized environmental accounting at the national and international level. Nevertheless, policymakers in both developed and developing countries are calling for environmental cost-benefit analyses of projects and policies. Such environmental accounting at the national level would provide a standardized data base with international credibility, providing the analyses needed to promote sustainable development.

Agricultural Policy Reform

Agricultural policies around the world have often created economic inefficiencies while subsidizing the destruction of our principal agricultural assets — our waters, soils and forests. Policies that ensure sustainable agriculture are essential to sustainable development.

Currently, price supports in developed countries distort production and put excess grain on international markets, jeopardizing the income-earning potential of hundreds of millions of farmers in developing countries. For example, agricultural support payments cost American taxpayers about $12 thousand-million annually. The Economic Community and Japan also subsidize agriculture heavily and, total support of agriculture in other industrialized countries (by consumers and taxpayers) has been estimated at $150 thousand-million annually. Unfortunately these same policies encourage the heavy use of fertilizers and pesticides to increase yields imposing further costs on the public.

In developing countries, food and agricultural prices may be held low for the benefit of the urban poor and to the detriment of the rural producers who may well make up a large proportion of the population.

Below-cost pricing of agricultural chemicals, credit and irrigation provide poor compensation by encouraging overuse of chemicals and scarce groundwater. In turn, cheap credit is typically rationed to the most powerful and may be used to encourage activities (like cattle ranching) on land that would best be left out of production.

Pesticides have been estimated to cause perhaps 20,000 deaths and one million illnesses per year worldwide — primarily in developing countries. In Africa and Asia, agriculture accounts for over 80 percent of water use and acute shortages have been felt in many countries in the Middle East and North Africa. Cheap credit to encourage beef exports in Central America led to some of the highest deforestation rates

PESTICIDE REFORM IN INDONESIA

One such positive initiative is the removal of pesticide subsidies in Indonesia, where the government previously sold them to farmers at prices below cost. Like many other developing countries, Indonesia had promoted the use of agricultural pesticides under a strategy to achieve growth in agricultural production and self-sufficiency in rice. The program had also included generous subsidies to other agricultural inputs, especially fertilizers, seeds, irrigation water and credit. Pesticides were subsidized under a program of supervised credit, but since extension agents were in short supply, pesticides were often applied without much attention to the best recommended practice.

Under the subsidies, pesticide use increased 76 percent between 1979 and 1985. In 1985 it was estimated that pesticides were subsidized at 82 percent of the retail price, at an annual cost of $128 million. But the high cost of the program was only one factor which led to its termination.

Natural predators of an insect known as the brown planthopper were wiped out by the widespread use of the pesticide Sevin, and millions of tons of rice were lost to this pest which had not previously been considered a threat. Studies showed that the overuse of pesticides led to resistant strains of pests and reductions in productivity. Designed to increase agricultural production, these policies had the opposite effect.

Fifty-seven brands of pesticides were banned in November 1986. By the same decree, Indonesia adopted a strategy of integrated pest management (IPM) for rice production based on encouraging natural predators. Pesticide use dropped 90 percent within three growing seasons and yields rose close to 20 percent. In December 1988 pesticide subsidies were eliminated entirely and farm prices were increased to help farmers adjust to the policy change. With these new policies, Indonesia is in a better position to foster both growth in agriculture and improved environmental management.

in the world during the late 1970s and early 1980s, and subsequent high rates of erosion. Nevertheless, a number of positive initiatives toward more sustainable agricultural policies are being made around the globe.

Agricultural Reform in Developed Nations

Substantial reforms are still needed in developed countries — including the United States — to make agricultural policies more sustainable. Policies which provide subsidies, restrict imports or subsidize exports encourage farmers to expand land holdings and to increase farm inputs for higher production.

In the United States, for example, subsidy payments based on past average yields encourage the over-use of fertilizers to keep yields high. The yield for any particular year is averaged into a five-year base yield. The higher the base yield, the higher future payments will be — not only for that year but for years into the future. Thus farmers have an extra incentive to keep yields high.

These kinds of policies also discourage rotations involving crops not included in the "commodity programs." Although crop rotation has the advantage of replenishing the soil productivity and controlling crop-specific pests, it can also reduce future support payments by reducing the base area, upon which those subsidies are made.

Agricultural policies in Japan and Western Europe encourage over-production in similar ways, at a high cost to consumers, taxpayers and to the environment as well. Farmers in the European Community have been paid as much as four times world prices causing chronic surpluses which are then dumped into world markets at subsidy. Recognizing a comparative disadvantage in agriculture, Japan defends its protectionist policies on the basis of food security. Rice is both a staple and a national symbol, but consumers bear the cost.

The global accord achieved in December 1993 through the Uruguay Round trade negotiations brings agricultural trade under global trade rules for the first time. Although some countries were disappointed that the agreement did not go further toward eliminating all trade barriers, most agree that cuts in government supports for agriculture and the opening of markets heretofore closed to imports were among the trade negotiation's greatest achievements.

Under the Uruguay Round agreement, countries must reduce the amount they spend on export subsidies by 36 percent and the volume of their subsidized exports by 21 percent over six years. Import bans, import quotas and other barriers to market access must be converted to tariffs by July 1, 1995. In products where current import levels are below five percent of domestic consumption, countries must make a minimum-access commitment to phase in five-percent access for imports. Existing and new tariffs will be reduced over a six-year-period, and then will be "bound" so that they cannot rise in the future. Thus the Uruguay Round agreement lifts Japanese and South Korean bans on rice imports, and phases out U.S. quotas on imports of sugar, dairy products and peanuts.

Reduced export subsidies would reduce production in the developed nations and increase agricultural prices

CONSERVATION POLICIES IN THE UNITED STATES

In spite of the need for further reform, agricultural policies in the United States are rapidly developing an environmental consciousness.

The Soil Conservation Service (SCS) was established in 1935 in response to the devastation in the "Dust Bowl" region in the Midwest, where millions of hectares of farmland were lost due to drought and poor land management techniques. Since then the SCS has been responsible for cooperating with farmers in developing suitable soil and water management practices. Three thousand conservation districts have been established to provide technical assistance to farmers on over 800,000 hectares of land. As a result, hundreds of thousands of American farmers have learned that soil conservation practices such as contour farming, grass waterways and reduced tillage can increase farm income while improving water and soil management.

By 1985, however, environmental groups had become active on farm issues. Both the 1985 and 1990 farm bills passed by the U.S. Congress balanced environmental concerns against the positions of more traditional agricultural interest groups.

Under the 1985 farm bill, a Conservation Reserve Program (CRP) was established with the dual purpose of reducing output and taking erodible lands out of production. For the first time legislation tied farm income to compliance with soil conservation practices. Participating farmers agreed to retire the marginal lands from production — usually planting a cover crop of perennial grasses — in exchange for an annual rental payment from the U.S. government. Thirty-two to 36 million hectares were targeted for retirement by 1995. The bill also included "sod- and swamp-buster programs" which discouraged conversion of highly erodible lands and wetlands into farmland by making farmers who converted such lands without conservation measures ineligible for participation in price support programs.

The 1990 farm bill supplemented the CRP with three new environmental programs including: 1) the Wetlands Reserve Program which targets 400,000 hectares to be set aside for bird and wildlife habitat and paid for with easements of 30 years or longer; 2) the Water Quality Incentive Program which provides incentive payments of up to $3,500 per year for farm management that improves water quality in the area and targets four million hectares by 1995; and 3) the Integrated Farm Management program under which farmers submit plans for preventing soil erosion, improving soil fertility and water management, and interrupting pest cycles. Under this last program farmers also set aside 20 percent of farmland for a resource-conserving crop. The enrollment goal for 1995 is 1.2 million hectares.

These new programs have already achieved limited success and may certainly be further refined and improved in the upcoming 1995 farm bill. One goal of the programs is to limit agricultural production, thereby raising agricultural prices and reducing potential subsidy payments that currently make up for low prices. But the environment benefits as well.

Original wetlands in the United States have been reduced by more than half — 485,000 square kilometers — but the new provisions will help to restore wildlife habitat, providing benefits to all who enjoy the outdoors, financing benefits for businesses involved in tourism and helping to maintain U.S. ecosystems. Although these benefits, along with the water purification role of wetlands, are difficult if not impossible to quantify, they are nevertheless real.

The Water Quality Act of 1987 recognized agriculture as a principal source of pollutants that affect water quality and imposed measures to limit its threat to the environment. A study of 78 estuaries in the United States found that agriculture contributed 24 percent of "nutrient loading" (increases in plant nutrients which contribute to the overgrowth of plant life in the estuaries) and 40 percent of sediment. Sediment is particularly costly — eroded agricultural soils fill up reservoirs reducing their flood-control potential, clog waterways and impose additional costs on water-treatment facilities. Recreational value is damaged and fishing potential is lost. Total damage from soil erosion is estimated at $10 thousand-million annually, although 36 percent of this may be due to eroded cropland.

The degree to which insecticides, fungicides and rodenticides used in agriculture affect food safety is carefully monitored in the United States. However, pesticides are beginning to contaminate water supplies. Surveys in Minnesota and Iowa suggest that 30 to 60 percent of private wells and 20 to 30 percent of community wells may contain pesticide residues. Pesticide runoff is also found in surface water and studies have shown that conventional water treatment procedures generally do not remove pesticide residue. Simple techniques like crop rotations interrupt pest cycles and often eliminate the need for pesticides while maintaining yields. The Integrated Farm Management program under the 1990 farm bill provides incentives for these kinds of changes.

for producers in less-developed countries. Under free-market conditions, marginal, environmentally fragile lands such as wetland and arid or hilly terrain would go out of production, promoting both environmental protection and economic efficiency. In other words, sustainable development.

PRESERVING INTERNATIONAL BIODIVERSITY FOR ECONOMIC DEVELOPMENT

Economic incentives already exist within individual countries to eliminate agricultural subsidies that encourage environmental degradation, but preserving the world's biodiversity will require developed and developing nations to work together.

The biologically rich tropical rainforests of the developing world contain much of the world's remaining biodiversity. And although the timber and forest products have recognizable commercial value, the aesthetic and commercial values in preserving biological diversity are sometimes less appreciated.

Major initiatives for international cooperation have already begun. Over 150 countries have already signed an International Convention on Biological Diversity with the aim of conserving and using the earth's genetic wealth sustainably. A Global Environmental Fund has also been established under the supervision of the World Bank to transfer resources to developing nations for the preservation of their biological wealth.

Private, international commercial initiatives are also under way. Travel companies in developed countries have joined forces with nature preserves in developing nations for the benefit of both. Pharmaceutical companies have also invested in cataloging and preserving tropical rainforests in the hope of commercial gain. These ventures have resulted in economic growth and development while working to preserve biological diversity.

PROSPECTING FOR BIODIVERSITY

The importance of maintaining biological diversity surpasses moral and aesthetic reasons, for as species disappear, the balance of the ecosystems upon which life depends becomes more precarious. Quantifying this precisely is still elusive. But what is now becoming more clear is the value of genetic diversity for the pharmaceutical, biotechnology and agricultural industries.

New technological developments have recently increased demand for raw genetic materials for possible biochemical and pharmaceutical products. With this increase in demand, the rules governing the ownership and access to genetic resources are in a state of transition.

Many of the ethical and financial issues involved in this were addressed in the International Convention on Biological Diversity, but implementation will take some time. While international debate continues and national governments study the issues, commercial arrangements to facilitate access to genetic and biochemical resources have already emerged.

A notable example is the September 1991 contract between the National Biodiversity Institute (INBio), a nonprofit organization in Costa Rica, and the U.S.-based pharmaceutical firm, Merck & Co., Ltd. For its small size (51,000-square kilometers), Costa

ECO-TOURISM IN AFRICA

The exotic large game animals of Africa attract both tourists and safari hunters. By charging a fair price to these tourists and hunters, and using the proceeds to control illegal poaching, countries like Kenya, Rwanda, Zambia and Zimbabwe increased both their wildlife stocks and their commercial revenues from tourism.

In Kenya and Rwanda, nature tourism or eco-tourism contributes substantially to the economy. Protected areas in Kenya generate revenue of up to $500 million — both directly and indirectly — about 30 percent of Kenya's foreign exchange. The World Bank invested in the expansion of nature tourism in Kenya's Amboseli National Park not out of environmental, but financial concern: expected returns from park tourism were $40 per hectare, compared to $.80 per hectare for agricultural uses.

Successful eco-tourism ventures establish fees high enough to limit entrance and keep parks from being over-run. The high fees for viewing nature's bounty may seem inappropriate, but foreign tourists who travel to Africa are willing to pay for air fare and first class accommodations for this opportunity.

Returning tourism proceeds to the local population is also a major ingredient for successful eco-tourism. In Zambia's Luangwa Valley, a wildlife fund was established to finance additional park personnel: auctioning hunting rights among safari hunting companies finance 60 percent of the fund. As a result, 40 percent of the auction proceeds were turned over to local chiefs for community projects. Once the local populations shared in the economic benefits from maintaining game populations, the poaching of elephants and black rhinos fell in two years by a remarkable 90 percent.

Rica boasts enormous biological wealth: one estimate is that fully four percent of all living species are found in the country.

As the first such contract of its kind, the INBio-Merck agreement has set precedent for other developing countries and commercial interests who seek economic benefit by preserving and using biodiversity.

Under the agreement, INBio is providing Merck chemical extracts from micro-organisms, plants and insects from Costa Rican nature preserves, which constitute 25 percent of the land area in the country. Merck will screen the samples for potentially valuable chemicals.

In exchange for the samples, Merck has agreed to contribute $1,135,000 toward INBio's efforts to catalog the species and gather samples, as well as pay royalties on any commercial products that might result. Ten percent of this budget and 50 percent of any royalties are to be directed to the government's National Park Fund.

Although it is a private non-profit and non-governmental organization, INBio was established in 1989 with close government supervision and cooperation. Its objectives were to study the biodiversity of Costa Rica to use this information in a non-destructive way to further economic and intellectual development — both within and without the country.

While the process of drug discovery has long been managed and staffed by experts from developed countries, INBio is moving the process to Costa Rica and involving the nation's scientists and museum curators, as well as the rural communities surrounding the national parks. INBio has hired local citizens and resisted the temptation to rely on foreign volunteers to collect field samples for the inventory of Costa Rica's biodiversity. As they work, the field personnel gain valuable experience. The wages and knowledge they bring home give them a much higher stake in preserving their country's biological wealth.

INBio actively cooperates with others around the country, including universities, government agencies and other non-governmental organizations. Their goal is to include as many people as possible in the venture. The national biodiversity inventory is a formal collaboration with the Costa Rican Ministry of Natural Resources. INBio also subcontracts out much sample processing, extracting and chemical analysis, to Costa Rican university laboratories. By so doing, they not only spread the new income around the country, but also increase national research capacity.

INBio plans to put its entire inventory in the public domain through electronic mail on the Internet. While it is still a pilot project, this uniquely Costa Rican experiment may help preserve biodiversity around the world.

CONCLUSIONS

Our natural environment is enormously valuable for economic production. Examples, as the case studies show, abound.

Preserving biodiversity is consistent with increased tourist revenues, and pharmaceutical companies have already begun to invest large sums in developing countries interested in preserving, knowing and using their biological and genetic resources. Agricultural policy reforms in both developed and developing countries can improve economic efficiency and protect natural resources. Likewise, extending firm property rights to local forest dwellers and users can encourage investment and more far-sighted management for economic and environmental sustainability. Finally, when we account for the depletion and destruction of natural productive assets as we do man-made assets, it becomes much more clear that the environment is indeed economically productive — destroying it reduces our wealth and our productive potential.

GLOSSARY

Base area: *The average area planted to a particular commodity in the past five years, under the U.S. commodity programs.*

Biodiversity prospecting: *The exploration of biodiversity for commercially valuable genetic and biochemical resources.*

Commodity programs: *Crop specific agricultural price support programs. U.S. commodity programs covered include wheat, corn, oats, sorghum, rye, barley, cotton and rice.*

Earth Summit: *United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, June 1992.*

Eco-tourism: *Tourism that involves traveling to natural areas with the specific objective of studying, admiring or otherwise enjoying the scenery and its wild plants and animals.*

General Agreement on Tariffs and Trade (GATT): *A multilateral trade agreement (currently with 117-member countries) established at the end of World War II and aimed at expanding international trade as a means of raising world welfare. GATT also refers to the organization, headquartered in Geneva, through which member parties consult regarding application of the provisions of the agreement.*

Global Environmental Facility (GEF): *Established by the World Bank, the U.N. Development Program and the U.N. Environment Program in 1990 to provide concessional assistance to the developing world for investments that protect biological diversity, the ozone layer or international water resources, or investments that reduce greenhouse gas emissions.*

International Convention on Biological Diversity: *An international agreement drawn up by the United Nations in preparation for the Earth Summit in Rio de Janeiro in June 1992. Not signed by the United States at the Earth Summit, it has now been signed by over 150 countries, including the United States.*

National accounts: *Economic accounting systems of nations designed to measure national income, consumption, investment, etc. Most national accounting systems adhere rather closely to guidelines established by the United Nations for international comparability.*

Open access resources: *Resources that belong to no one and are thus open to exploitation by all. Also, resources that are exploited as if they belonged to no one.*

Satellite environmental accounts: *Environmental accounts constructed according to the U.N. guidelines established in the 1993 revision, that are maintained separately from the core economic accounts, but that are entirely compatible with them.*

Sustainable development: *Changes in economic structure, organization and activity of an economic ecological system that are directed towards maximum welfare and which can be sustained by available resources.*

Sustainable agriculture: *Agricultural systems that provide for conservation and replenishment of the natural resources upon which continued agricultural production depends.*

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